THURSDAY, NOVEMBER 30, 1899.

## THE INHERITANCE OF DEAFNESS.

*Marriages of the Deaf in America.* By Edward Allen Fay. Pp. 527. (Washington: The Volta Bureau, 1898.)

MR. FAY'S work is an inquiry concerning the results of marriages of the deaf in America, a research originally instituted by Dr. A. Graham Bell among the charges which he committed to the Volta Bureau when he endowed that institution. When Mr. Fay undertook this work—as a labour of love—the resources of the Bureau were placed at his disposal, and he was further helped in his investigations by his Government appointment as a special agent for the collection of statistics relating to the deaf of the United States during the taking of the eleventh census. By these means Mr. Fay was particularly well equipped for his work, and the volume before us is no mean result. Taking as the chief aims of his inquiry the solution of certain questions of interest and importance to the deaf as a class and as individuals, he has sought by all the means in his power to obtain satisfactory replies, and his success will be seen by all who care to give the book a careful study. The questions to be elucidated were as follows:—

(1) Are marriages of deaf persons more liable to result in deaf offspring than ordinary marriages?

(2) Are marriages in which both of the partners are deaf more liable to result in deaf offspring than marriages in which one of the partners is deaf and the other is a hearing person?

(3) Are certain classes of the deaf, however they may marry, more liable than others to have deaf children? If so, how are these classes respectively composed, and what are the conditions that increase or diminish this liability?

(4) Aside from the question of the liability of the offspring to deafness, are marriages in which both of the partners are deaf more likely to result happily than marriages in which one of the partners is deaf and the other a hearing person?

These are questions which have been submitted to considerable discussion both in Europe and America, with the result that the conclusions arrived at have differed widely. Indeed the conclusions have ranged between the dictum of Graham Bell, that "the evidence shows a tendency to the formation of a deaf variety of the human race in America," on the one hand, to that of the Commissioners of the Irish census of 1881, that "it appears evident that the question of deafness and dumbness in parents has no influence in propagating the defect."

Mr. Fay's inquiry commenced in 1889, and the work has continued uninterruptedly since that time. Exhaustive questions were sent out and about, and the replies received were both more numerous and more complete than was anticipated.

It would be beyond the purpose or scope of this review to enter with any detail into the large number of statistics placed before Mr. Fay's readers; suffice it to say that they bear the stamp of having been most carefully collected, tested, and arranged, and may therefore be taken as more trustworthy than statistics are usually found to be. In the tabular statement of marriages details are given of no less than 4471 unions—a fact that will give the reader some idea of the onerous nature of Mr. Fay's task.

It appears that marriages of the deaf are more common in America than in Europe, and they have increased at a high rate of progression during the present century. From the statistics it appears that marriages of deaf persons, one or both of the partners being deaf, are far more liable to result in deaf offspring than ordinary marriages. The proportion of deaf marriages resulting in deaf offspring is 9·7 per cent., and the proportion of deaf children born therefrom is 8·6 per cent. Accurate data as to the proportion of deaf children born of ordinary marriages are not easily obtainable, but that proportion is probably less than 1·10 per cent. On the other hand, marriages of the deaf are far more likely to result in hearing offspring, the proportion of hearing children being 75 per cent.

These results are in accordance with the two laws of heredity: (1) that a physical anomaly tends to be transmitted to the offspring, and (2) that offspring tend to revert to the normal type.

There is a greater liability to deaf offspring of marriages of the congenitally deaf, since congenital or innate characteristics are far more likely to be transmitted than are acquired characteristics.

It appears also that deaf persons having deaf relatives, however they are married, and hearing persons having deaf relatives and married to deaf partners, are very liable to have deaf offspring. Finally, the marriages of the deaf most liable to result in deaf children are those in which the partners are related by consanguinity.

The most important statistics (summed up in a separate table) are those showing the number of marriages of each class of which the results are reported and the number and percentage of each class resulting in deaf children, with the number of children born from marriages of each class, and giving the number and percentage of those deaf. These statistics show the comparative liability to deaf offspring of the several classes of marriages.

As regards the *happiness* of deaf unions, marriages in which both parties are deaf appear to be more likely, other things being equal, to result happily than those in which one of the partners is deaf and the other possesses normal hearing; the proportion of divorces and separations in the former class being 2·5 per cent., in the latter 6·4 per cent. This is easily explainable on the grounds of mutual fellowship and identity of social relations and sympathies which arise from the union of individuals suffering from similar conditions.

An appendix is devoted to illegitimate unions, but the totals of their statistics are too small to furnish any certain basis for trustworthy conclusions.

Mr. Fay has produced a valuable work, and one which should take a prominent place in the literature—necessarily not a very large one—of the subject. From a careful perusal one cannot fail to note the clearness of his statements and the logical way in which he works

© 1899 Nature Publishing Group

out his deductions. There is but one thing lacking, and that is the devotion of any special chapter to those diseases of the ear—notably the condition known as middle ear sclerosis—acknowledged to be hereditary, or to the diseases of the throat and nose which are predisposing causes of deficient hearing power. Considering the large percentage of all forms of nasal obstruction existing in the condition of civilisation—a percentage larger, we believe, in America than in Europe—it would be of interest to investigate the influences diseases of the throat and nose exercise upon the marriages of persons suffering therefrom.

In spite of the fact that statistics are always somewhat dry, and the deductions given from those in Mr. Fay's work are put without useless verbiage, the book is a very readable one to those interested in all branches of the subject, and should rank high as a work of reference.

MACLEOD YEARSLEY.

---

## *THE LIQUEFACTION OF GASES.*

*The Rise and Development of the Liquefaction of Gases.* By Willett L. Hardin, Ph.D. Pp. viii+250. (New York: The Macmillan Co. London: Macmillan and Co., Ltd., 1899.)

*La Liquéfaction des Gaz et ses Applications.* By Prof. Julien Lefèvre. Pp. 175. (Paris: Gauthier-Villars et Fils, and Masson et Cie.)

A BOOK should be criticised with reference to the author's professed object in writing it. Dr. Hardin professes to have written for the popular reader, in the popular science style. Regarded from this point of view the work deserves a good deal of praise. It is, in the first place, interesting to read, collecting, as it does, a great many facts connected with the development of low-temperature research, and detailing numerous experiments which are explained with the assistance of copious and clear illustrations. It may therefore be recommended, with the reservations which are made below, to those who, with a very elementary knowledge of physics, desire to learn something of the details of recent progress in a very interesting subject. The recommendation should be all the heartier because the author's style is free from the patriotic brag and boom which disfigure another recent American book on the same subject, and because the right side is taken as to the marvellous industrial revolutions heralded from America as a consequence of later work in this department of science. A further merit in the work is the abundance of exact references to original authorities, for the benefit, as stated in the preface, of those who wish for fuller information.

The fact, however, that the author had the latter object in view emphasises what should be a binding obligation even in books intended solely for popular reading, namely, to take care that such science as is introduced shall be strictly correct; and this obligation Dr. Hardin has fallen short of in a serious degree. On pp. 183-185 he reproduces Edwin J. Houston's suggestions for an apparatus to produce intense refrigeration. The nearest thing to a novelty in these suggestions is the proposal to modify Windhausen's machine by substituting a two-stage compressor for a single-stage one, and so obtaining a higher pressure of sixty atmospheres. He expressly retains Windhausen's system of power expansion in a cylinder doing work on a piston; yet Dr. Hardin says:

> "In the apparatus suggested, Houston anticipated the methods which were employed twenty years later in the liquefaction of air by Linde, Hampson and Tripler."

This is inexcusable in one who undertakes to "enable the popular reader to understand the principles involved." The same confusion is repeated much more deliberately later on. On pp. 205–208 the author works out mathematically the formula for the cooling produced by power expansion, $\left(\frac{p}{p_1}\right)^{\frac{k-1}{k}} = \frac{T}{T_1}$, which he calls equation (7). He then says:

> "Applying these results to the liquefaction of gases by means of the regenerative coil, it is evident that the expansion of the gas in the tube lowers the temperature by an amount which corresponds to equation (7)."

The formula for power expansion is here applied where we ought to have had Thomson's formula for free expansion, $-\frac{d\theta}{dp} = A\left(\frac{273{\cdot}7}{t}\right)^2$. The title of the section is "Theory of the Self-intensification Method of Refrigeration," and a note, at the foot of the same page, refers us to Joule and Thomson for a more complete discussion, which, however, in the body of the section, instead of being abridged or summarised, is altogether replaced by another analysis. The way in which the book is written gives no reason to suppose that Dr. Hardin is incapable of distinguishing between the very different conditions involved in power-expansion and free expansion, or the very different mathematical analyses appropriate to these two sets of conditions. The only tolerable explanation of such a gross confusion is that it has never come in Dr. Hardin's way to read Thomson's papers on the cooling of gases by free expansion, or to examine intimately the nature of the phenomena involved, and so he has carelessly applied to these phenomena the well-known formula for cooling by power-expansion. This is not the proper way to write a book even for the satisfaction of the interest of the popular reader. These are not the only instances that the author shows of a lack of thorough acquaintance with his subject. If he had studied Mr. Tripler's British patent of 1893, which is put forth as the foundation of his claims as inventor of a form of self-intensive air-liquefier, and had paid attention to the chronology of the subject, Dr. Hardin would perhaps not have felt justified in treating those claims so well as he has done, by describing those parts of Mr. Tripler's apparatus which are not kept secret. On p. 227, the author gives Prof. Dewar's conclusion, that the liquefying points of hydrogen and helium are near together, without giving the subsequent correction.

The style of the writing is occasionally careless and slipshod, and the meaning sometimes undiscoverable. On p. 209 we are told

> "the issuing jet experiences a much greater decrease in temperature owing to the greater difference between the initial and final pressures."

© 1899 Nature Publishing Group